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Chromosomes of Fifteen Species of Bats (Chiroptera) from Kenya and Rhodesia

by R. L. Peterson¹ and David W. Nagorsen²

Abstract—Karyotypes of 15 species of African Chiroptera (*Epomops franqueti*, *Epomophorus crypturus*, *E. gambianus*, *E. wahlbergi*, *Nycteris thebaica*, *Hipposideros caffer*, *Rhinolophus hildebrandti*, *R. darlingi*, *R. denti*, *Pipistrellus nanus*, *Eptesicus hottentotus*, *E. capensis*, *Scotophilus nigrita*, *Tadarida bivittata*, and *T. fulminans*) were studied. An XO male sex chromosome system was discovered in *E. crypturus* and *E. gambianus*. Distinctive marker chromosomes occurred in 14 species. [Karyotypes; Chiroptera; Africa; Kenya; Rhodesia]

Introduction—Data on chiropteran karyotypes were reviewed by Baker (1970) and Capanna and Civitelli (1970). Nonetheless, karyotypic data for African Chiroptera are few. Our purpose here is to describe the chromosomes of 15 species of African bats representing six families and briefly to compare results with known karyotypic data of related species (Table 1). The karyological material was obtained by the senior author during field studies in Kenya and Rhodesia in 1972.

Materials and Methods—Slides of somatic chromosomes were prepared using the *in vivo* bone marrow technique described by Baker (1970). Although some slides were stained in the field, most were stained in the laboratory. Metaphase spreads were photographed with Kodak High Contrast Copy film 5069 using a Reichert Zetopan photomicroscope at a magnification of 630 $\times$ under oil immersion. To determine the diploid number (2N), a minimum of 12 spreads was counted for each specimen. Nomenclature for chromosomal morphology is that of Patton (1967). Fundamental number (FN) is defined as the number of autosomal arms. Metacentric, submetacentric, and subtelocentric chromosomes are assigned a value of two, and acrocentrics a value of one. Because chromosome morphology may vary in metaphase spreads as a result of different degrees of chromosome contraction, karyotypes presented in the figures may not correspond exactly to descriptions in the text. The descriptions of karyotypes and fundamental number of each species were based on photographs of a minimum of four but

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usually more metaphase spreads. Specimens reported herein are in the collections of the Department of Mammalogy, Royal Ontario Museum (ROM).

Specimens Examined

PTEROPODIDAE

Epomops franqueti Tomes. KENYA. Southern Province: Hunters Lodge, near Makindu (02°18'S, 37°50'E), 2 ♀♀.

Epomophorus crypturus Peters. RHODESIA. Nuanetsi District: Nuanetsi Ranch (21°22'S, 30°45'E), 1 ♂, 1 ♀.

Epomophorus wahlbergi Sundevall. RHODESIA. Umtali District: Umtali (18°57'S, 32°40'E), 2 ♀♀.

Epomophorus gambianus Ogilby. RHODESIA. Victoria District: 20 mi (32.2 km) SE Fort Victoria (20°14'S, 31°02'E), 2 ♂♂.

NYCTERIDAE

Nycteris thebaica E. Geoffrey. RHODESIA. Lomagundi District: Triumph Mine, near Lake McIlwaine (17°49'S, 30°46'E), 2 ♀♀; Umtali District: Umtali, 2 ♀♀; Bikita District: 7 mi (11.2 km) W Birchenough Bridge (19°54'S, 32°14'E), 1 ♂; Victoria District: Garden Cave, Zimbabwe National Park, (20°16'S, 30°55'E), 1 ♂.

HIPPOSIDERIDAE

Hipposideros caffer Sundevall. RHODESIA. Matobo District: 10 mi (16.1 km) S Bulawayo (20°15'S, 28°36'E), 1 ♀; Victoria District: Garden Cave, Zimbabwe National Park, 1 ♂.

RHINOLOPHIDAE

Rhinolophus hildebrandti Peters. RHODESIA. Salisbury District: Singeneri Hills, 18 mi (28.9 km) N Salisbury (17°31'S, 31°02'E), 2 ♀♀; Lomagundi District: Triumph Mine, near Lake McIlwaine, 1 ♂; Matobo District: 10 mi (16.1 km) S Bulawayo, 1 ♂; Victoria

District: 20 mi (32.2 km) SE Fort Victoria, 1 ♂.

Rhinolophus darlingi Andersen. RHODESIA. Salisbury District: 2 mi (3.2 km) N Lake McIlwaine (17°47'S, 30°49'E), 1 ♂, 1 ♀, *Rhinolophus denti* Thomas. RHODESIA. Victoria District: Zimbabwe National Park (20°16'S, 30°55'E), 1 ♂, 1 ♀.

VESPERTILIONIDAE

Eptesicus capensis A. Smith. RHODESIA. Nuanetsi District: Nuanetsi Ranch, 1 ♂, 2 ♀♀.

Eptesicus hottentotus A. Smith. RHODESIA. Bindura District: Chikupu Cave (17°24'S, 31°20'E), 1 ♂; Victoria District: 20 mi (32.2 km) SE Fort Victoria, 1 ♀.

Pipistrellus nanus Peters. RHODESIA. Victoria District: 20 mi (32.2 km) SE Fort Victoria, 1 ♂.

Scotophilus nigrita Schreber. RHODESIA. Nuanetsi District: Nuanetsi Ranch, 1 ♀.

MOLOSSIDAE

Tadarida fulminans Thomas. RHODESIA. Bindura District: Chikupu Cave, 2 ♂♂, 2 ♀♀ (Topotypes of *T. mastersoni*).

Tadarida bivittata Heuglin. KENYA. Southern Province: 8 mi (12.8 km) NW Makindu (02°12'S, 37°43'E), 1 ♂. RHODESIA. Bindura District: Chikupu Cave, 2 ♂♂, 1 ♀ (Topotypes of *T. rhodesia* Roberts).

Results and Discussion

PTEROPODIDAE

Epomops franqueti (2 ♀♀), 2N = 36, FN = 68.

The chromosome complement (Fig. 1A) consists of eight pairs of metacentrics, seven pairs of submetacentrics, and three pairs of subtelocentrics. A pair of metacentric chromosomes has secondary constrictions in one arm. This characteristic marker chromo-

Fig. 1—Representative karyotypes of three species of Pteropodidae. Arrows indicate marker chromosomes. Scale bars = 10 μ m.

A. *Epomops franqueti*, female, 2N = 36, FN = 68.

B. *Epomophorus crypturus*, female, 2N = 36, FN = 68.

C. *Epomophorus gambianus*, male, 2N = 35, FN = 68.

A

XX XX XX XX XX XX XX

↑

XX XX XX XX XX XX

XX XX

—

B

XX XX XX XX XX

↑

XX XX XX XX XX XX

XX XX XX XX

XX
XX

—

C

XX XX XX XX XX

↑

XX XX XX XX XX XX

XX XX XX XX

X
X

—

some appears in the four species of Megachiroptera that we examined. We were unable to distinguish the X chromosomes because males were not studied.

Epomophorus crypturus (1 ♂), $2N = 35$, $FN = 68$; (1 ♀), $2N = 36$, $FN = 68$.

Autosomes (Fig. 1B) consist of six pairs of metacentrics, seven pairs of submetacentrics, and four pairs of subtelocentrics. A metacentric marker chromosome, morphologically identical with that of *Epomops franqueti*, is present in the karyotype. All complements counted (20) from the female specimen had a diploid number of 36, whereas all complements counted (21) from the male specimen had a diploid number of 35. A small, submetacentric chromosome is lacking in the male, and *Epomophorus crypturus* presumably has an XX/XO sex chromosome system.

Epomophorus gambianus (2 ♂♂), $2N = 35$, $FN = 68$.

The karyotype (Fig. 1C) appears to be identical with that of *E. crypturus*. Autosomes consist of six pairs of metacentrics, including a metacentric marker chromosome, seven pairs of submetacentrics, and four pairs of subtelocentrics. Of 77 spreads counted, 57 (74 per cent) had a diploid number of 35, 15 (20 per cent) a diploid number of 34, and five (six per cent) a diploid number of 33. Variation in diploid number probably results from cell rupture and chromosome loss during preparation of slides. No spreads were found with a diploid number of 36. The male sex chromosome system is XO and the X is a submetacentric. The female sex chromosome system could not be verified as XX because females were not examined.

Epomophorus wahlbergi (2 ♀♀), $2N = 36$, $FN = 68$.

The chromosome complement appears to be identical with *E. crypturus* and *E. gambianus*, with six metacentrics, eight submeta-

centrics, and four subtelocentrics. The submetacentric chromosome with secondary constrictions in one arm occurs in this species. Males may have an XO sex chromosome system but this is yet to be confirmed.

In the four species of African Pteropodidae studied, the morphology of the autosomes and the fundamental number (68) are similar or identical. Minor differences in the morphology of the banded chromosomes of *Epomops franqueti* can be explained by postulating the occurrence of pericentric inversions. Dulic and Mutere (1973a) reported a fundamental number of 72 (including sex chromosomes) for *Epomophorus anurus*. Characteristic of the karyotype of species of *Epomops* and *Epomophorus* that we studied is the presence of a pair of morphologically identical marker chromosomes. A similar pair of chromosomes was described for the African pteropids *Rousettus aegyptiacus* and *E. anurus* (Dulic and Mutere, 1973a) and for three species of Indian Megachiroptera, *Cynopterus sphinx*, *Pteropus giganteus*, and *Rousettus leschenaulti* (Pathak, 1965a, 1965b, 1966). Further study is required to determine whether this chromosome occurs in other species of African Megachiroptera.

Although all female representatives of *Epomophorus* studied to date have a diploid number of 36, male *E. crypturus* and *E. gambianus* have diploid numbers of 35 (Table 1). These two species appear to have an XO male sex chromosome system, with the Y chromosome possibly translocated to an autosome. An XX/XO sex chromosome system, rare in mammals, has been reported in only two species of Chiroptera, *Mesophylla macconnelli* (Baker and Hsu, 1970) and *Vampyressa pusilla* (Baker et al., 1973). In both species, the authors speculated that the Y chromosome had been translocated to an autosome. Dulic and Mutere (1973a), however, reported a diploid number of 36 and typical XY sex chromosomes for a male *Epomophorus wahlbergi*. Further karyotypic analysis, including meiotic studies, is required to verify the heterosomic system in species of *Epomophorus*.

Table 1. Summary of karyotypic data for African bats. M = metacentric; SM = submetacentric; ST = subtelocentric; A = acrocentric.

Family and species	2N	FN	X	Y	♂♂	♀♀	Authority
Pteropodidae							
<i>Epomops franqueti</i>	36	68	—	—	—	2	this paper
<i>Epomophorus crypturus</i>	36(♀)	68	SM	—	—	1	ibid.
	35(♂)	68	SM	—	1	—	ibid.
<i>Epomophorus gambianus</i>	35(♂♂)	68	SM	—	2	—	ibid.
<i>Epomophorus wahlbergi</i>	36(♀♀)	68	—	—	—	2	ibid.
	36(♂)	68	SM	A	1	—	Dulic & Mutere, 1973a
<i>Epomophorus anurus</i>	36(♀)	72 ¹	—	—	—	1	ibid.
<i>Rousettus aegyptiacus</i>	36	66	SM	?	3	1	ibid.
Nycteridae							
<i>Nycteris thebaica</i>	42	78	SM	M	2	4	this paper
Hipposideridae							
<i>Hipposideros caffer</i>	32	60	ST	A	1	1	ibid.
Rhinolophidae							
<i>Rhinolophus hildebrandti</i>	58	60	ST	ST	3	2	ibid.
<i>Rhinolophus darlingi</i>	58	60	ST	ST	1	1	ibid.
<i>Rhinolophus denti</i>	58	62	ST	—	1	1	ibid.
Vespertilionidae							
<i>Pipistrellus nanus</i>	36	50	M	A	1	—	ibid.
<i>Eptesicus hottentotus</i>	50	48	SM	—	1	1	ibid.
<i>Eptesicus capensis</i>	32	50	SM	A	1	2	ibid.
<i>Scotophilus nigrata</i>	36	62 ¹	—	—	—	1	ibid.
Molossidae							
<i>Tadarida bivittata</i>	48	54(?)	SM	A	3	1	ibid.
<i>Tadarida fulminans</i>	48	54(?)	M	A	2	2	ibid.
<i>Tadarida condylura</i>	48	56	SM	A	4	2	Dulic & Mutere, 1973b
<i>Tadarida pumila</i>	48	58	SM	A	3	6	ibid.
<i>Otomops martiensseni</i>	48	58	SM	SM	1	—	Warner et al., 1974
	48	56	M	A	5	2	Dulic & Mutere, 1973b
<i>Platymops setiger</i>	48	54	SM	SM	1	—	Warner et al. 1974

¹FN calculation includes sex chromosomes.

NYCTERIDAE

Nycteris thebaica (2 ♂♂, 4 ♀♀), 2N = 42, FN = 78.

Autosomes (Fig. 2A) consist of nine pairs of metacentrics, seven pairs of submetacentrics, three pairs of subtelocentrics, and one pair of acrocentrics. The X chromosome is a submetacentric, and the Y is a small metacentric chromosome. A pair of metacentric chromosomes has secondary constrictions in one arm of each homolog. In some metaphase spreads only one chromosome of the pair appears to have the secondary constrictions. Studies of other species of *Nycteris* are required to determine if this is a marker chromosome for the genus. Bovey (1949), who studied testicular material of an undetermined species of *Nycteris* from Cameroon, reported a diploid number of 42, a

fundamental number of 79, and heterosomes similar to those described here from *N. thebaica*.

HIPPOSIDERIDAE

Hipposideros caffer (1 ♂, 1 ♀), 2N = 32, FN = 60.

Autosomes (Fig. 2B) consist of four pairs of metacentrics, eight pairs of submetacentrics, and three pairs of subtelocentrics. The X chromosome is a subtelocentric, and the Y is the only acrocentric in the chromosome complement. A pair of submetacentrics has secondary constrictions in one arm. The secondary constrictions vary considerably, appearing on both chromosomes in some spreads and on one chromosome of the pair in others, or being absent in both chromosomes in still other spreads. Ray-Chaudhuri

et al. (1971) reported similar karyotypes ($2N = 32$ and $FN = 60$) in *Hipposideros ater* and *H. fulvus*, two Indian species.

RHINOLOPHIDAE

Rhinolophus hildebrandti (3 ♂♂, 2 ♀♀), $2N = 58$, $FN = 60$.

Autosomes (Fig. 2c) consist of a graded series of 26 pairs of acrocentrics, a pair of submetacentrics, and a pair of metacentrics. One pair of acrocentrics has secondary constrictions in the chromosome arm in the region adjacent to the centromere. This chromosome appears in the three species of Rhinolophidae we examined, although in some complements the secondary constrictions are present in only one member of the pair. The X and Y chromosomes are subtelocentric.

Rhinolophus darlingi (1 ♂, 1 ♀), $2N = 58$, $FN = 60$.

The karyotype (Fig. 3A) appears to be identical with that of *R. hildebrandti*, and autosomes consist of a graded series of 26 pairs of acrocentrics, one pair of submetacentrics, and one pair of metacentrics. Sex chromosomes consist of a subtelocentric X and a subtelocentric Y. An acrocentric with secondary constrictions is also present in the karyotype of this species.

Rhinolophus denti (1 ♂, 1 ♀), $2N = 58$, $FN = 62$.

Autosomes (Fig. 3B) consist of a graded series of 25 pairs of acrocentrics, one pair of submetacentrics, one pair of metacentrics, and one pair of minute metacentrics. The marker chromosome described for *R. darlingi* and *R. hildebrandti* is also present in *R. denti*. Although possibly an artifact of staining, the regions of secondary constriction in this chromosome appear to be greater in *R. denti* than that in *R. darlingi* and *R. hildebrandti*. The X chromosome was de-

termined to be a subtelocentric, but the Y chromosome was not distinguished because of the poor staining quality of male complements.

Although we found no karyotypic data for African species of Rhinolophidae in the literature, Capanna and Civitelli (1970) reviewed karyotypic data of five European species of this family and found a marker chromosome to be present in three of these species but lacking in two. Described as satellited by Capanna and Civitelli (1970), this chromosome appears to be similar to the marker chromosome that we described for the three species of African Rhinolophidae. Further investigation is required to determine if this chromosome is absent in any species of African Rhinolophidae.

Although *R. hildebrandti*, *R. darlingi*, and *R. denti* represent three different phyletic lines within the Rhinolophidae, their karyotypes are similar (Table 1). Karyological differences of *R. denti* from the other two species may be explained by postulating a pericentric inversion in one of the small chromosomes.

VESPERTILIONIDAE

Pipistrellus nanus (1 ♂), $2N = 36$, $FN = 50$. Autosomes (Fig. 3c) consist of four pairs of metacentrics, four pairs of submetacentrics, and nine pairs of acrocentrics. The largest pair of acrocentrics has prominent, secondary constrictions in the region adjacent to the centromere. The X chromosome is a metacentric, and the Y is an acrocentric.

Eptesicus hottentotus (1 ♂, 1 ♀), $2N = 50$, $FN = 48$.

Autosomes (Fig. 4A) consist of a graded series of 24 pairs of acrocentrics. One pair has secondary constrictions in the region adjacent to the centromere. The X chromo-

Fig. 2—Representative karyotypes of one species of Nycteridae, one species of Hipposideridae, and one species of Rhinolophidae. Arrows indicate marker chromosomes. Scale bars = 10 μ m.

A. *Nycteris thebaica*, female, $2N = 42$, $FN = 78$.

B. *Hipposideros caffer*, male, $2N = 32$, $FN = 60$.

C. *Rhinolophus hildebrandti*, male, $2N = 58$, $FN = 60$.

A

XX XK XH HX XX Xx xX xX xX



HH HX HX HX HX HX xX

XX HH HX ~

HH
XX



B

KK XX KK XX

XX XX XH HK XX xX xX xX



HH xX xX

HH
XY



C

nn nn nn nn n~ nn nn nn

nn nn nn nn nn ~n nn nn



nn ~n nn nn nn nn ~n nn ~n

xx xx

xx
XY



some, a submetacentric, is the only biarmed chromosome in the karyotype. Poor staining quality of complements from the male made it impossible to determine the morphology of the Y chromosome.

Eptesicus capensis (1 ♂, 2 ♀♀), $2N = 32$, $FN = 50$.

Autosomes (Fig. 4B) consist of three pairs of metacentrics, seven pairs of submetacentrics, and five pairs of acrocentrics. Prominent secondary constrictions in the region adjacent to the centromere are present in one pair of submetacentrics. The X chromosome is a submetacentric, and the Y is an acrocentric.

Scotophilus nigrita (1 ♀), $2N = 36$, $FN = ?$ The chromosome complement (Fig. 4C) consists of five pairs of metacentrics, four pairs of submetacentrics, four pairs of subtelocentrics, and five pairs of acrocentrics. Several pairs of acrocentrics appear to have small secondary arms in some metaphase spreads. Secondary constrictions in one arm are present in the smallest pair of metacentrics. As males were not examined, the X chromosome and the fundamental number were not determined.

Although we found no published karyotypic data for the African Vespertilionidae, considerable data exists for Asiatic, European, and American species. Capanna and Civitelli (1970) reviewed chromosomal data for *Pipistrellus*, a genus whose species demonstrate considerable karyotypic variation. The karyotype of *P. nanus* suggests a close affinity with two European species, *P. kuhlii* and *P. savii*, whose karyotypes were described by Capanna (1968). In these three species the fundamental number is 50; whereas the fundamental number for American and Asiatic species of *Pipistrellus* is variable. The karyotype of *P. nanus* ($2N = 36$) differs from that of *P. kuhlii* and *P.*

savii ($2N = 44$) by the presence of four, extra biarmed chromosomes and by the absence of eight acrocentrics, a difference that may be explained by a Robertsonian fusion-fission mechanism. Further evidence of the close affinity of these three species is the presence of a pair of morphologically identical, acrocentric chromosomes with prominent secondary constrictions. This distinctive marker chromosome has not yet been identified in any of the Asiatic or American species of *Pipistrellus* (Capanna and Civitelli, 1970).

The karyotype of *E. hottentotus* closely resembles the karyotypes described by Baker and Patton (1967) for three American species, *E. fuscus*, *E. andinus*, and *E. furi-nalis*. However, the marker chromosome present in *E. hottentotus* was not described by Baker and Patton (1967) for the three American species. The chromosome complement of *E. capensis* differs from that of *E. hottentotus* in diploid number and fundamental number (Table 1). The presence of nine pairs of large, biarmed chromosomes and a reduced number of acrocentrics in *E. capensis* suggests that Robertsonian fusion-fission mechanisms produced these karyotypic differences; but as the fundamental number of *E. capensis* is 50 and that of *E. hottentotus* is 48, such non-Robertsonian mechanisms as pericentric inversions must also have been responsible for these differences.

A diploid number of 36 and a pair of metacentric marker chromosomes were reported for *Scotophilus temminckii*, *S. kuhlii*, and *S. heathi* by Pathak and Sharma (1969) and by Sharma et al. (1974). Although the sex chromosomes are unknown, the karyotype of *S. nigrita*, including the presence of the metacentric marker chromosome, appears to be similar to those of these three Indian species.

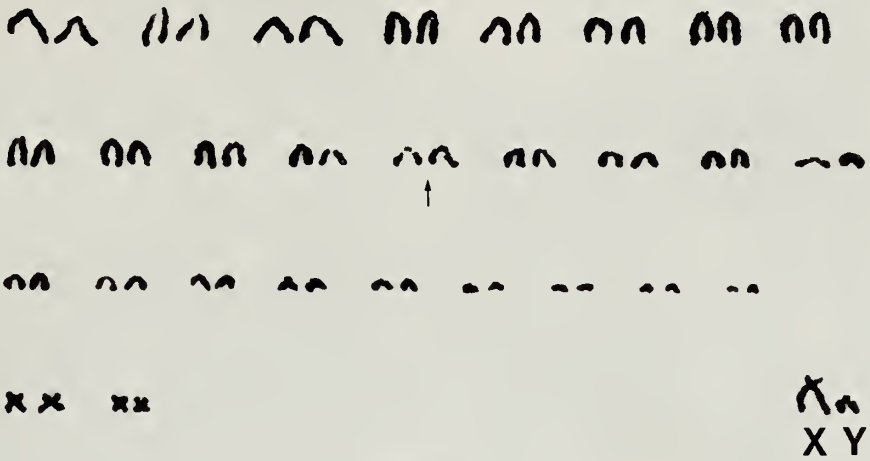
Fig. 3—Representative karyotypes of two species of Rhinolophidae and one species of Vespertilionidae. Arrows indicate marker chromosomes. Scale bars = 10 μ m.

A. *Rhinolophus darlingi*, male, $2N = 58$, $FN = 60$.

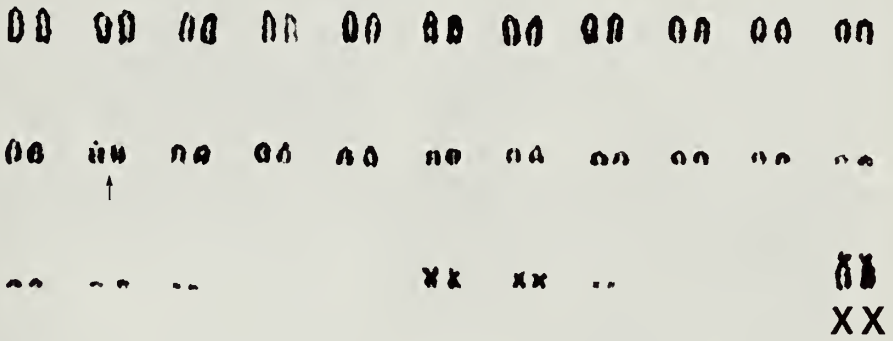
B. *Rhinolophus denti*, female, $2N = 58$, $FN = 62$.

C. *Pipistrellus nanus*, male, $2N = 36$, $FN = 50$.

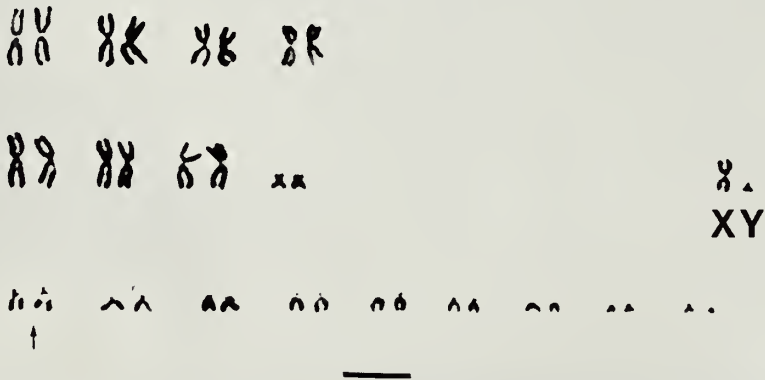
A



B



C



Tadarida bivittata (3 ♂♂, 1 ♀), 2N = 48, FN = 54 (?).

The autosomal complement (Fig. 5A) consists of two pairs of metacentrics, two pairs of submetacentrics, and a graded series of 19 pairs of acrocentrics or subtelocentrics. Some acrocentrics appear to have small secondary arms, but this condition varies in different metaphase spreads even from the same specimen. Nonetheless, for consistency these chromosomes are considered to be acrocentric and assigned a value of 1 when determining the fundamental number. Consequently, the fundamental number in *T. bivittata* is considered to be questionable. The X chromosome is submetacentric, and the Y is an acrocentric.

Tadarida fulminans (2 ♂♂, 2 ♀♀), 2N = 48, FN = 54 (?).

Autosomes of this species are similar to *T. bivittata*, with two pairs of metacentrics, two pairs of submetacentrics, and a graded series of 19 pairs of acrocentrics or subtelocentrics. Moreover, acrocentrics appear to be subtelocentric in some spreads, and the fundamental number is an arbitrary one. One pair of acrocentrics is characterized by having secondary constrictions. The X chromosome is a metacentric, and the Y is an acrocentric.

Karyotypic data given here for *T. bivittata* and *T. fulminans* are similar to those of *T. pumila* and *T. condylura*, two other African species whose karyotypes were described by Dulic and Mutere (1973b) (Table 1). The major difference among these four species is the size and shape of the sex chromosomes, particularly the Y. Karyotypes are remarkably similar to those of American species of *Tadarida* (Baker, 1970; Warner et al., 1974) and the karyotype is apparently stable and homogeneous in species of this genus. An autosomal pair of acrocentric

chromosomes with secondary constrictions was reported in *Otomops martiensseni* (Dulic and Mutere, 1973b) and in species of *Eumops*, *Molossus*, *Promops*, and American *Tadarida* (Warner et al., 1974). We found a similar pair of chromosomes in *T. fulminans* but not in *T. bivittata*. Dulic and Mutere (1973b) did not report this marker chromosome in karyotypes of *T. condylura* and *T. pumila*.

Résumé—Des caryotypes de quinze espèces de Chiroptères de provenance africaine (Kenya et Rhodésie) ont été étudiés. Le nombre diploïde (2N) et le nombre fondamental autosomique (NF) de ces espèces sont les suivants: *Epomops franqueti* 2N = 36, NF = 68; *Epomophorus crypturus* 2N = 35 (♂), 36 (♀), NF = 68; *Epomophorus gambianus* 2N = 35 (♂♂), NF = 68; *Epomophorus wahlbergi* 2N = 36 (♀♀), NF = 68; *Nycteris thebaica* 2N = 42, NF = 78; *Hipposideros caffer* 2N = 32, NF = 60; *Rhinolophus hildebrandti* 2N = 58, NF = 60; *Rhinolophus darlingi* 2N = 58, NF = 60; *Rhinolophus denti* 2N = 58, NF = 62; *Pipistrellus nanus* 2N = 36, NF = 50; *Eptesicus hottentotus* 2N = 50, NF = 48; *Eptesicus capensis* 2N = 32, NF = 50; *Scotophilus nigrita* 2N = 36, NF = ?; *Tadarida bivittata* 2N = 48, NF = 54 (?); *Tadarida fulminans* 2N = 48, NF = 54 (?). Un système rare du chromosome XO (sexe mâle) a été découvert chez *E. crypturus* et *E. gambianus*. Des chromosomes caractéristiques qui montrent des constrictions secondaires se trouvent chez quatorze de ces espèces.

Acknowledgments—We express our gratitude to the following: Dr. Robert J. Baker, Dept. of Biology, and The Museum, Texas Tech University, Lubbock, for instruction in the karyotyping technique; Mr. Geoffrey

Fig. 4—Representative karyotypes of three species of Vespertilionidae. Arrows indicate marker chromosomes. Scale bars = 10 μ m.

- A. *Eptesicus hottentotus*, female, 2N = 50, FN = 48.
- B. *Eptesicus capensis*, male, 2N = 32, FN = 50.
- C. *Scotophilus nigrita*, female, 2N = 36, FN = ?

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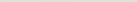
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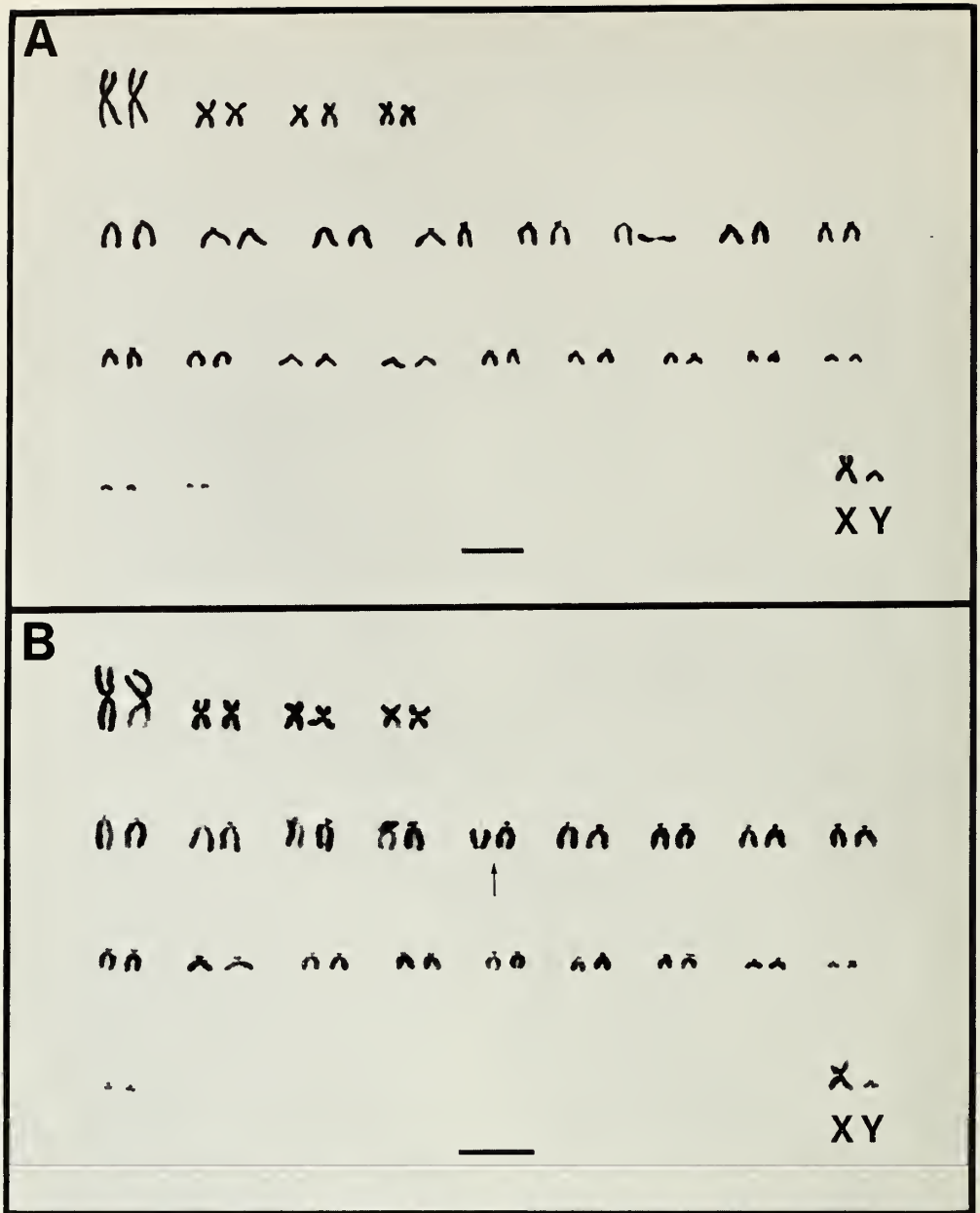


Fig 5—Representative karyotypes of two species of Molossidae. Arrow indicates marker chromosomes.
 Scale bars = 10 μ m.
 A. *Tadarida bivittata*, male, 2N = 48, FN = 54 (?).
 B. *Tadarida fulminans*, male, 2N = 48, FN = 54 (?).

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